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EXAMINER

LUHRS, MICHAEL K

ART UNIT PAPER NUMBER

2824

DATE MAILED: 11/20/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/843,924

Applicant(s)

SAKURAI ET AL.

Examiner

Michael K. Luhrs

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) 28-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-27, 31 and 32 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 April 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☒ Other: search history.

DETAILED ACTION

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper. Restriction is made final.

Specification

1. Specification: p. 7, line 23, change "Fig. 713(A)", to read --Fig.13(A)--.
2. Specification: p. 8, line 1, change "Fig. 17(A)" to read --Fig.19--.
3. Specification: p. 20, line 26, change "flux" to read --flush--.
4. Claims: remove "any one of" from line 1, of both, claim 9, and claim 10.
5. The abstract of the disclosure is objected to because in the specification: p. 17, line 23, "anisotropically conductive material 74"; Wouldn't it be a non-conductive material-- clearly 74 is shown throughout the area and is not related to the bonding method using anisotropic conductive film made of microcapsules e.g. line 59 column 1, '692, is therefore inappropriate here, please verify? Correction is required. See MPEP § 608.01(b).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

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6. Claims 1-3, 5-8, 10, 13, 15, 17, 18, 20, 21, 25, 26, 31 and 32 are rejected under 35 U.S.C. 102(e) as being anticipated by Saitoh USPN 6,093,964.

Regarding claim 1, Saitoh discloses forming the opening in oxide insulative film to expose electrode pad 3, (lines 28-29, column 4, the oxide is unassigned layer between layers 3 and 5 in Fig. 5). Saitoh discloses forming bump structure 11 connected to pad 3 in Fig. 4, (line 7, column 4). Saitoh forms a resist layer 7, having opening over the pad 3 as shown in Fig. 6, (line 35, column 4). Saitoh forms gold metal layer 13, (line 37, column 4) connected to the exposed pad via electrode layer 5 (lines 31-34, column 4).

Regarding claim 2, Saitoh forms the through hole so as not to protrude from a periphery of the pad as it is shown in Fig. 5, i.e. the (unassigned) oxide layer is shown above the pad at the edges of the pad, therefore the hole does not protrude past the ends of the pad.

Regarding claim 3, Saitoh fails to show the insulative oxide thicker at the end of the pad than at the center.

Regarding claim 5, Saitoh discloses a gold metal layer as the first metal layer 13 (line 37, column 4) and indium metal layer 15, (line 47, column 4) as second metal layer is formed on first metal layer, the gold layer (line 48, column 4). Layers 13 and 15 are shown in more than one profile Figs. 3, 4 and 7 and 8 and the indium layer 15 is formed on the first metal layer the gold layer 13.

Regarding claim 6, Saitoh forms resist layer 7 larger than a periphery of the through hole (formed in the insulative layer) to define the area for the first metal layer 13, as shown in Fig. 6, the second metal layer 15 is formed as shown in Fig. 3 to cover the exposed area of the pad, i.e. layer 15 extends further to the

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pad edges than layer 13 to cover the exposed pad areas. Saitoh discloses the method of reflow of the indium second layer (line 58, column 4) to cover the exposed portion of the pad.

Regarding claim 7, Saitoh discloses first metal layer 13 formed in the hole, (lines 36-37, column 4), and then removes the photoresist (line 51, column 4), and subsequently reflows the second metal layer, the indium layer 15, in order to form the second metal layer so as to cover the first metal layer (line 57, column 4).

Regarding claim 8, Saitoh discloses forming the first metal layer within the opening of the photoresist opening, discussed above, and forms the second metal layer 15, without removing the photoresist layer 7 in two instances shown in Figs. 7 or 8.

Regarding claim 10, Saitoh discloses the second metal layer so as to protrude from the through hole with a tip larger than the through hole as shown in Fig. 7.

Regarding claim 13, Saitoh teaches providing solder on the metal layer, inherently, (lines 49-50 column 6, and lines 61-63 column 6) the second layer is the solder, and also provides that general solder can be also be provided (line 65, column 6).

Regarding claim 15, Saitoh provides the metal layer substantially flush with the resist as layer is flush with photoresist in Fig. 6 and again layers 13 and 15 are substantially flush with resist 7 in Fig. 8, whereas, solder layer as an indium layer formed directly on a metal bump serves as a brazing filler, i.e. consider the indium as solder in a TAB application, and Saitoh also provides the general solder (line 65,

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column 6), is added to the metal layer exposed from the resist as described in the abstract (lines 7-9) when connection is made.

Regarding claim 17, Saitoh provides conductive layer 5 on insulative film (unassigned) as shown in Fig. 5 connected to the first metal layer 13 shown in Fig. 6 at the periphery of the hole; the first metal layer 13 shown lower than the resist; the second metal layer 15, the indium, provided by electroplating (plating described at lines 48-50, column 4) uses layer 5 as electrode (line 38, column 4).

Regarding claim 18, Saitoh provides that different metals can be used as the first metal, see claim 14 (line 29, column 8) which lists nickel.

Regarding claim 20, Saitoh inherently include the second metal layer including a solder, since the second metal layer are known solder metals, (lines 34-35 column 3).

Regarding claim 21, it has been pointed out that in the instance of direct bump to lead, super soldering, the second layer *is* the solder in accordance with lines 61-63 column 6, lists tin, lead, bismuth and alloys of them. Performed by heating as known in the art for connecting a lead to a pad, without solder, per se.

Regarding claim 25, Saitoh teach the device formed by the method of claim 1, since the metal layer is formed on the pad formed of the semiconductor chip, and the Figures represent the chip to be connected to a substrate, i.e. (line 67, column 6).

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Regarding claim 26, Saitoh teaches the above claim 25 further of connecting the bump to a lead in the instance of TAB method, super solder, line 2 column 7 is performed for providing electrical connection from bump to lead at low temperature (line 15 column 7) is the eutectic inherently formed.

Regarding claim 27, product by process, having previously stated above for claim 25, as being taught by Saitoh, the identification of the product by process as a limitation in claim 27 is thus thereby inherent to having manufactured the device comprised of the bump in accordance with claim 1, as having the metal layer being formed on the pad of the semiconductor chip, as addressed above.

Regarding claims, 31 and 32, it would be inherently inclusive to Saitoh to further provide the devices, circuit board and electronic device, comprising the device in accordance with claim 27, given claim 27's inherency to the indicated devices, as pad on chip, thus further, chip on circuit board, circuit board in device, are inherent, since a chip is provided to/on a board and board to the device.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1, 5, 11, 12, and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Chikawa (USPN 5,310,699).

Regarding claim 1 Chikawa teaches forming opening in insulative film as a passivation film 4 (line 8, column 4) (Note that a passivation layer by definition, can be considered as an insulative layer, see Lu et. al., lines 17-18, column 2).; forming bump connected to pad as bump 7 (line 45-51 column 4), connected to electrode pad 3 (lines 6-7, column 4), shown in Fig. 2D, forming resist layer 9 having overlap of the pad as shown in Fig. 2D, and forming metal layer 6 connected to pad 3 (line 30, column 4), also shown in Fig. 2D.

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Regarding claim 5, Chikawa teaches metal layer 6, can be as first and second metal, eg. Gold-titanium tungsten (line 59, column 1), as described in lines 13-29 column 4, and also as a multiple of layers including at least two layers (line 50 column 2), titanium (line 10, column 5) and further gold-nickel-chromium or platinum-nickel-chromium (lines 14-15, column 5), is thus a first metal and a second metal layer formed on the first metal layer, e.g., layer 6' and layer 6'' described in lines 23 and 25 respectively, column 4, Fig. 2D et.al..

Regarding then, claims 11 and 12, Chikawa teaches that the first metal layer 6', i.e. the titanium tungsten (line 23, column 4), and second metal layer 6'', i.e. the gold (line 25, column 4), can be formed by electroless plating, e.g. by sputtering, (lines 14-15, column 4).

Regarding claim 19, Chikawa teaches that the second metal layer be of gold (lines 25-26 column 4).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Saitoh in ^{right}view of ~~in re~~ ¹
Larson, 340 F 2d 965, 967, 144 USPQ 347, 349 (CCPA 1965).

Regarding claim 9, Saitoh fails to disclose forming the first metal layer so as to protrude from the hole so that the first metal layer has a tip having a width which is larger than a width of the through hole. (Rather Saitoh does so, with the second metal layer as shown in Fig. 7). It has been shown however, that it would be obvious to form an integral part from a part having two parts, and therefore it would have been obvious

at the time the invention was made to a person having ordinary skill in the art to form the first metal layer in a single part to form the bump, instead of formed the bump electrode in two parts with first and second metal layers as Saitoh has done, would be obvious and is not patentable based on *in re Larson*.

9. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Saitoh (or Chikawa) in view of Nakamura et. al.(USPN 6,372,547).

Regarding claim 14, Saitoh (or Chikaw) do not expressly disclose a resin layer at a periphery of the metal layer. Nakamura et. al. disclose a resin layer in examples 1-4 (for example, in example 1, the resin is ejected between the solder balls, lines 48-49, column 7, and, in example 4 the resin is provided and then etched to form a hole (line 24, column 10) is provided for the purpose of improving the mounting reliability (last line in each of respective examples). Since Nakamura et. al. and Saitoh (or Chikawa) are all from the same field of endeavor the purpose disclosed by Nakamura et. al. would have been recognized in the pertinent art of Saitoh (or Chikawa). It would have been obvious at the time the invention was made to add/provide a resin layer (to Saitoh or Chikawa) at a periphery of the metal layer *other than on at least an upper face of the metal layer so that the solder is provided to a portion of the metal layer that is exposed from the resin layer*, as expressed by Nakamura et. al. for hole 44 for solder paste (line 27, column 10), to improve the mounting reliability, discussed above.

10. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Saitoh in view of Nakamura et. al..

Saitoh teaches the first metal i.e. the gold layer 13 below the (height of) resist, but fails to disclose the printing process for the second metal layer using the resist as a mask. This is taught by Nakamura et. al. . For example, solder paste is coated by metal printing (lines 26-28 column 10) as a manner to provide the solder to the electrode. Since Nakamura et. al. and Saitoh are all from the same field of endeavor the

purpose disclosed by Nakamura et. al. would have been recognized in the pertinent art of Saitoh. It would have been obvious at the time the invention was made to provide the solder via printing paste as taught by Nakamura et. al. as a substitute to the method of providing the solder by electroplating taught by Saitoh, for the obvious motivation of even higher reliability, (last line of example 4).

11. Claims 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chikawa in view of Lin et. al. (USPN 5,830,533).

Regarding claims 22-24, Chikawa fails to disclose the second layer of claim 12 that includes a first and second layer, wherein the first and second are immersion and autocatalytically plated. (Claim 22 Au/Au, Claim 23 Au/Sn) and where the Sn in claim 23 is an electroless tin plating solution with Cu and Ag. Lin et. al. disclose an immersion and autocatalytic technique for providing metallization in bump layers. Since Lin et. al. and Chikawa are all from the same field of endeavor the purpose of providing a first layer by immersion to provide a initiator or seed, and second layer of either Au or Sn autocatalytically, as taught by Lin et. al. to comprise the overall second layer, would have been obvious as an alternative deposition technique to the second layer electroplating technique taught by Chikawa. It would have been obvious at the time the invention was made to substitute the deposition technique as taught by Lin et. al. for the plating taught by Chikawa as an alternative for providing the layers of a bump. Lin et. al. cite the non-uniformity of electrolytically deposited metal. The Au/Sn is taught by Mita et. al. (USPN 6,297,142) for solder, column 11. It would have been obvious at the time the invention was made to utilize a lead-free solder in place of the indium taught by Saitoh for the same reason of Saitoh adds the indium over the gold for eutectic connection to a lead.

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Conclusion


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael K. Luhrs whose telephone number is 703-305-2864. The examiner can normally be reached on M-F; 8:00 a.m. - 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard T. Elms can be reached on 703-308-2816. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.



Michael K. Luhrs
November 18, 2002



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